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January 7, 1998

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FEDERAL COMMUNICATIONS COMMISSION
OFFICE OF THE SECRETARY

Ms. Magalie Roman Salas
Secretary
Federal Communications Commission
1919 M Street, N.W.
Room 222
Washington, D.C. 20554

Re: Ex Parte Presentation
In the Matter Advanced Television Systems and Their Impact Upon the Existing Television Broadcast Service;
MM Docket No. 87-268

Dear Ms. Salas:

This letter notifies the Commission that Mr. Charles Rhodes faxed the attached materials to Mr. Robert Eckert and Mr. Robert Bromery of the Office of Engineering and Technology on January 3, 1998. The materials, which principally consist of an advance copy of Mr. Rhodes' column in TV Technology, address the conversion of Threshold to Visibility ("Tov") interference data to CCIR 3 interference data and the FCC's current planning factors for DTV to DTV and DTV to NTSC adjacent channel interference.

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In accordance with the Commission's Rules, two copies of this letter and the attachments are being filed with the Secretary for inclusion in the public record of this proceeding.

Sincerely,

Thomas P. Van Wazer

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Attachment

cc: Robert Eckert
Robert Bromery

Charles W. Rhodes
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January 3rd 1998

Messrs. Robert Bromery and
Robert Eckert
c/o FCC

By Telecopier: (202) 418-1918

Dear Friends:

As I promised Bob Eckert, here is a pre-print of my column which will appear in the February issue of "TV TECHNOLOGY". I have slightly simplified this analysis by not delving into the weightings of sideband splatter from n-1 vs. n+1 which ammounts to +/- 2 dB. That should indeed be considered in my opinion.

While these matters seem perfectly clear to me as the writer, they may not really be so clear to others. I'll be traveling the entire week of 5-10 January, but should you call my home, I'll call you back. I'll be attending the Consumer Electronics Show. Should be very interesting.

In the event that you make another computer run with the "newly discovery data" I wonder if it might not be a good idea to see what happens if the second or third adjacent channels are tried out before the computer moves on. It would be better to have to contend with sideband splatter easily 60 dB down.

Cordially,

Charlie Rhodes

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January 2nd 1998

Ms. Traci Sabalik,
Editor "TV TECHNOLOGY"

Dear Traci:

Here is Chapter XXV, the first for 1998.

The subject of DTV channel allotments continues to be a major concern to many broadcasters. Recently, a number of filings with the FCC have addressed the problems of the FCC Table of DTV Allotments, in its Sixth Further Report and Order and some parties have proposed solutions to problems they are concerned with.

One of the greatest concern exists over DTV channels which are adjacent to existing NTSC allotments or to other DTV allotments where there is a large disparity in the maximum Effective Radiated Power (ERP) of the signals to be on adjacent channels. The second popular issue is over the present disparity in Effective Radiated Power (ERP) between DTV allotments, ranging as it does from a minimum ERP of 50 kw to a maximum of 1,000 kw this 20:1 ratio is 13 dB. Lets review the DTV into an Adjacent NTSC channel problem.

First, the FCC Planning Factors are:

DTV interference from (n-1) to NTSC (n) - 17.43 dB

DTV interference from (n+1) to NTSC (n) - 11.95 dB

The Planning Factor for Lower Adjacent channel interference is a level of picture impairment deemed "perceptible but not annoying" : CCIR 3. For the other case, DTV on the Upper adjacent channel into NTSC, the Planning Factor is based on impairment to

BTSC Stereo sound. Those results were reported to the ATSC by the ATTC in its Final Report: Tables 4-1, 4-2 and 4-3. Why is this important? Because the interference criteria differ for (n-1) vs. (n+1). More on this later. These tests were conducted with no sideband splatter present in the DTV signal in the ATTC Laboratory.

It was the further work of the Advanced Television Technical Center Inc. (successor to the Advanced Television Test Center where I worked) that showed the interference to NTSC and to DTV signals on adjacent channels to be primarily due to sideband splatter from the DTV channel into the first adjacent channels, n+/-1 where there may be an NTSC or another DTV signal in residence. This was made known late in 1996 (DTV into NTSC) and in July 1997 in the case of DTV-DTV interference.

On October 22, 1996, the ATTC published its report on the effects of sideband splatter into an NTSC channel at the limits defined by the then proposed FCC RF Mask. The Threshold of Visibility of such interference was reported.

DTV interference from (n-1) into NTSC + 11.33 dB (at Tov)

DTV interference from (n+1) into NTSC + 7.33 dB (at Tov)

While these are very large differences, they are "apples-to-oranges" comparisons. The ATTC results were at Threshold of Visibility, while those which serve as the basis of the FCC Planning Factors are based on different criteria. How to adjust these further test results, to the FCC Criteria: CCIR Grade 3 impairment? The ATTC in its Final Report had reported the subjective effect of co-channel DTV into NTSC interference, (Page III-39). This data is shown as Figure 1 of this column. The interference is identical to that of "white noise". CCIR Grade 3 impairment is at a U level of -90 dBm for a D level of - 55 dBm or a D/U ratio of 35 dB. In this author's opinion, CCIR Grade 4.5 corresponds to Threshold of Visibility (Tov). From Figure 1, Tov was at a Undesired level of -103 dBm. Thus, the difference between CCIR Grades 4.5 and 3.0 is 13 dB for co-channel DTV into NTSC interference or for "white noise". This is the basis for a conversion factor from Tov to CCIR Grade 3 for sideband splatter also appears as noise. Now we can adjust the ATTC test data to CCIR Grade 3 impairment with this 13 dB factor. Table 1 provides this and the FCC Planning Factors;

Table 1: Comparison of FCC Planning Factors and ATTC results corrected to CCIR Grade 3 Impairment

	from n-1 DTV into NTSC	from n+1 DTV into NTSC
FCC	- 17.43 dB	- 11.95 dB
ATTC (CCIR-3)	- 1.67 dB	- 5.67 dB
Difference	15.76 dB	6.28 dB

Note: Much less Undesired (DTV) signal is permissible under these assumptions than under FCC Planning Factors.

The difference between Lower and Upper Adjacent channel Tov is 4 dB and this is precisely the difference in the weighted noise power of sideband splatter from Lower and Upper adjacent channels published in "TV TECHNOLOGY" in this column in the April 10, 1997 issue. That 4 dB difference was computed by applying the noise weighting factors which had been measured by the ATTC in June 1996.

Now we have an apples-to- apples comparison between the FCC Planning Factors and those which would be valid for sideband splatter at the level permitted under the now adopted FCC RF MASK. Table 1 also gives these differences.

Now we can estimate the picture quality for the FCC Planning Factors using the adjusted ATTC data from Table 1. For co-channel DTV into NTSC, we see that Grade 3 impairment results from a U level of -90 dBm. The ATTC reported in July 1997 that it had integrated the power under the FCC RF Mask in either adjacent channel relative to the average power of the DTV signal within its channel. The difference is 39.8 dB. Very similar results have been reported elsewhere. Call it 40 dB. On this basis, the -90 dBm figure from Figure 1 of the ATTC Report for co-channel interference is -50 dBm for sideband splatter, or a D/U of - 5 dB and the Desired NTSC signal was at - 55 dBm. Now look at the FCC D/U of -17.43 dB (for DTV below the NTSC channel). We see the difference is 12 dB. The FCC Planning Factor permits U levels 12 dB higher than we have calculated for CCIR Grade 3 picture impairment. What does 12 dB worse mean in picture impairments? From Figure 1, we see that at a 12 dB stronger U level than results in CCIR 3, U = - 78 dBm, the impairment is rated worse than CCIR 2 impairment. This then is one basis for concern by broadcasters with the present Allotment Table *when the FCC permits sideband splatter to be radiated up to the limit of the FCC RF Mask.* The RF Mask does not comport with the Allotment Table.

For the interference from the Upper adjacent channel, the FCC Planning Factor is 6 dB above what would give CCIR 3 picture impairment. From Figure 1, this is about the difference between CCIR 3 and CCIR 2 picture impairments. So here again, the RF Mask does not protect NTSC reception, but the difference is only 6 dB not 12 dB.

Let's look at where this interference may be expected, unless of course the FCC changes the procedure for allotting DTV channels which is what MSTV and others advocate.

Case 1: Co-Sited DTV & NTSC Adjacent Channel Allotments

Assume the DTV ERP is 1 Megawatt (30 dBK) and the NTSC ERP is 5 Megawatts (37 dBk), then the D/U ratio radiated is + 7 dB. This is about the Threshold of Visibility found by the ATTC. Assuming the two transmitting antenna patterns are well matched you can celebrate! If there is any practical way to radiate both signals from the same antenna, you would gain from such an implementation even if you would have to replace your present NTSC antenna.

If the DTV power is 50 kw (17 dBK) the D/U ratio is 13 dB better or + 20 dB, a very handsome margin for whatever antenna pattern differences there may be and this is where a side mounted DTV antenna may be expedient.

Case 2: Non-co-sited DTV & NTSC Adjacent Channel Allotments

Here is where the problem is.

For example, at 50 miles beyond your Grade B contour, a DTV transmitter on a channel adjacent to your with 100 kw ERP, and 1200 feet HAAT would have a Field Strength of 60 dB uV/M. Aside from any antenna discrimination against this interference, this station can be expected to contribute to the noise seen by your viewers at your Grade B contour. A 1000 kw DTV transmitter would of course have a 10 dB greater field strength.

Looking at Figure 1, if the Undesired DTV co-channel signal at -90 dBm impairs an NTSC picture received at -55 dBm, then for a DTV signal on either adjacent channel, the same effect would result when the DTV signal is on an adjacent channel and its field strength is -90 dBm + 40 dB = - 50 dBm. (D/U = - 5 dB). His sideband splatter may be only 40 dB down in your channel *per the RF Mask.* Your NTSC picture would degrade to about CCIR 2 if the interference were 10 dB greater. Let us hope your viewers at such locations have rotators on their highly directional antennas and, moreover use them!

Where you believe you might have such a problem, you should do (or contract for) an analysis of the potential interference. Perhaps a Longley-Rice analysis will show that the terrain between stations provides a significant degree of shielding of your coverage area from the interference which would be predicted using the classical methods which ignore terrain factors.

Suppose you are presently operating at significantly less ERP than permitted in your band (37 dBK at UHF) for example. You face some risk here because interference calculations are predicated on the assumption of a maximum facility. As a defensive strategy you may want to increase your facility.

Classical planning for DTV uses the FCC F(50,90) propagation data for the Desired signal, and F(50,10) propagation data for the Undesired signal (either another DTV or an NTSC signal). This is because the D & U signals have historically been allocated to physically distant communities. With DTV, we have adjacent channel allotments within the same community. Ideally these would be co-sited, but the ideal is not always the case in practice. The use of F(50,10) to calculate the Undesired Field Strength and thus, interference may not be appropriate where the two stations are close to each other, but not so close as to be considered as being co-sited. As a case in point, WETA in Washington, DC broadcasts on channel 26. The FCC has allocated channel 27 to this station for DTV. WETA finds that DTV transmission from its NTSC tower is not possible. It has an experimental DTV transmitting facility at another site just beyond what the FCC defines as being co-sited. While F(50,90) is certainly appropriate for analyzing DTV coverage, should F(50,10) be applied to analyze potential interference to its NTSC coverage? Fortunately, we may soon know.

Conclusions

A filter at the output of the DTV transmitter can reduce the sideband splatter as it affects NTSC reception on an adjacent channel. In fact, as this column has previously stated, in the DTV Field Tests at Charlotte, N.C. the transmitter output was filtered. The FCC does not require a filter. All that is required is that the sideband splatter fit under the RF Mask. By now, you see that this is no guarantee that there won't be unanticipated interference. An effective filter can and will affect the DTV signal within its assigned channel, however, the group envelope delay due to such a filter can be precorrected as a practical matter. Fortunately, the power dissipation (temperature rise) in such a filter is constant for DTV signals and therefore the frequency characteristics of such filters can be made quite stable.

There may be a filter in your future. Don't you hope the 'other guy has one in mind for his future (DTV transmitter).
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So, while some broadcasters face more interference to their NTSC signal from DTV signal on adjacent channels, and especially so from the lower adjacent channel, a filter can be an effective remedy. I expect we will see such filters at the forthcoming NAB. Meanwhile I'm off the to Consumer Electronics Show to see the first generation of DTV consumer products. This year what is shown at the CES is of great importance to broadcasters as we are about to start commercial DTV broadcasting. What will be available to consumers? Will consumer DTV receivers have the NTSC co-channel rejection filter? Will we find they have better adaptive channel equalizers than were tested by the ATTC? Why not, that work in still in its early stages of development. Perhaps some of these consumer products will be better at coping with dynamic ghosts, lets hope so. I expect to have something to share with the readers of this column from my CES visit.

Tune in next month.